DOCUMENT RESUME

ED 372 390 CS 214 414

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TITLE The Effect of Technology on Emergent Writing.
PUB DATE May 94
NOTE 40p.; Research Project, University of Alaska Southeast.
PUB TYPE Reports - Research/Technical (143)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS Comparative Analysis; Kindergarten; *Microcomputers; Primary Education; Student Surveys; *Writing Attitudes; Writing Processes; Writing Research
IDENTIFIERS Alaska; Beginning Writing; Computer Assisted Writing; *Emergent Literacy; Technology Utilization; *Writing Development

ABSTRACT

Noting that emergent literacy and technology are new educational fields that are just beginning to develop, a study explored the connection between emergent writing and technology by examining the effects on kindergarten children learning to write using a microcomputer. A group of kindergarten students attending North Star Elementary in Nikiski, Alaska, was divided into two groups. One group (15 students) acted as a control and wrote only in their journals. The other group (14 students) wrote only on computers. Both groups were compared for the rate of developmental growth in emergent literacy. Pre- and post-tests were administered to obtain baseline data. Students were also surveyed to determine their attitudes about computer based writing. Findings suggest that the experience of writing is more important than the writing tool that students choose to use. (Contains 8 references. Elizabeth Sulzby's classification scheme for forms of writing, a student survey, and two tables of data are attached.) (RS)

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The Effect of Technology on Emergent Writing

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May 1994

CS214414

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Abstract

The Effect of Technology on Emergent Writing

Diane McBee

Emergent literacy and technology are new educational fields that are just beginning to develop. Classroom teachers need to meet these new challenges and start exposing young children to technology. Using the computer as a writing tool is one way to do this. This paper explores the connection between emergent writing and technology. It exams the effects of kindergarten children learning to write using a micro-computer. A group of students was divided two groups. One group would act as a control and would write only in their journals. The other group would write only on computers. Both groups were compared for the rate of developmental growth in emergent literacy. Pre- and post-tests were administered to obtain baseline data. Students were also surveyed to determine their attitudes about computer based writing. The results suggest that the experience of writing is more important than the writing tool that students choose to use;

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The advent of emergent literacy and computer technology is making an impact on the elementary classroom. The emergence of these innovations challenges educators to research and develop new programs that enhance the education of children. This paper explores the connection between emerging literacy and the use of computer-based writing for kindergarten students.

Literacy learning is a complex activity with social, linguistic, and psychological aspects. It is perceived to be multidimensional and tied to the child's natural surroundings. Learning to read and write begins early in life and is an interrelated process that develops in concert with oral language. It requires active participation and interaction with others (Strickland, 1990, 19-20). Literacy development should occur in all areas of a child's life.

At the kindergarten level, most children are using emergent forms of writing. These include scribbling, drawing, non-phonetic strings of letters, copying words from the environment, and inventive spelling. Few emergent writers have made the transition to conventional writing forms (Sulzby, 1992, 290).

A child is writing conventionally when a literate person is able to read the text using the three aspects of reading (letter-sound knowledge, concept of word, comprehension) in a flexible fashion. (Sulzby, 1992, 295). Children will begin using all the cueing systems and self-correcting themselves when they make mistakes as they begin to read conventionally.

Writing is a complex activity that requires the coordination and integration of numerous cognitive and metacognitive processes. Children must develop an understanding of different literary styles, an understanding of the mechanical, grammatical, and syntactic elements of writing, and the ability to access their own personal experiences (Kelly & O'Kelly, 1993, 4-5). They must be allowed to add to their knowledge base by interacting with literature and experimenting with the written word.

Conceptually, writing is a symbolic activity in which letters and forms represent objects and events. Emergent writers begin to form those connections between the written word and print as they examine the world of literacy.

The physical aspect of writing can be described as a concrete event, since it is experienced directly in relation to the fine motor actions of the writer (Olson & Johnston, 1989, 32). The physio-motor development that handwriting entails, however, may prevent many children from doing much writing until the first or second grade (Moxley & Warash, 1992, 140). They do not have the coordination necessary to successful manipulate a pencil. Writing by hand is labor-intensive (Fields & Spangler, 1994, 125) when you consider not only the physical, but also the mental skills that are involved.

With a computer, young children do not need to manipulate a pencil. Neither do they need to figure out the directionality of letters and print. Students need only to press a key. The results are a uniform print, similar to that found in books.

Questions that arise concern the effect that technology has on the development of emergent literacy, specifically writing Will children progress more rapidly with the use of technology? Will they exhibit the same developmental processes using computers as is displayed in writing with pencil and paper?

The computer used as a tool for writing can simplify the task of emergent writing for young children. Emergent writers do not always realize that handwritten words are the same as those in print (Keeton, 1992, 527). The similarity between words produced by a computer and words found in print should enhance a child's writing behaviors. Emergent writing should, therefore, develop more rapidly, when using the computer as the main writing tool.

Review of literature

Limited research has been done on the use of the computer as a writing tool for young children. Areas of inquiry have focused on either how young children use the computer as a writing tool, or how the computer gets incorporated into the literacy environment of the classroom. Little data has been collected on the impact of technology on the development of emergent writing.

In a project called "Computers in Early Literacy," children were invited to write emergently with computers. Emergent behaviors in both reading and writing were evident. The children used many different writing forms.

However, the software used clearly impacted the forms with which they wrote (Sulzby, 1992, 294). Scribbling and drawing were often times absent from the writing forms offered by available software.

Sharon Murphy in her article, "The Code, Connectionism, and Basals," disputed the claims made by Marilyn Adams concerning computer models based on the reading process. Most computer models were found to focus on word recognition and ignore the multiple cueing systems (graphophonic, syntactic, semantic, and pragmatic) that reading incorporates. Readers are forced to focus their attention on single words using these computer models. This rarely occurs in the true reading process. These models do not offer a valid literacy application.

Other computer models focused on simulations of human behavior. These programs were based on the concept of connectionism: the amount of memory would vary directly with the vividness, frequency, duration, and recency of the experience. In other words, sheer frequency of occurrence in specific contexts builds the patterns which others call rules (Murphy, 1991, 201).

However, the reliance on the use of computer simulations poses the question of whether or not the manner in which computers "learn" something is similar to the way humans learn. This report concludes that computer simulations are a disappointment because they can not take into account the fact that humans make their own rules about things they encounter and they then use these rules as a hypotheses for further interactions. Simply put, computers cannot think like humans, so again, these applications as they pertain to literacy can be considered flawed.

Another project conducted by Roy A. Moxley and Bobbie G. Warash of West Virginia University studied the question of how and when young children learn to write. This program provided computer-assisted writing to three prekindergarten children who had all begun with limited reading and writing skills. Information was sought on the developmental patterns of the children's writing as it pertained to spelling. The project entertained the plausibility that children may learn to write connected text more easily on the computer because the standardized print would enhance the children's use of visual information in spelling (Moxley & Warash, 1992, 138).

All the children in this study demonstrated considerable improvement in spelling and composition of connected text. The results of the study suggested further study of early writing by young children on the microcomputer. It was also suggested that children who have an ability to acquire oral language at an early age may also have the ability to acquire literacy at an early age (1992, 179). However, emergent literacy is more than learning how to spell words correctly.

The design of computer writing applications for children was the focal point in another project, one which specifically described the writing application *HyperTales*. Anthony E. Kelly and James B. O'Kelly of Rutgers University explored the principles of developmental literacy approaches that offer guidance in designing computer writing applications that complement the emergent literacy classroom. The following principles of literacy that were considered included:

* Children's literature is an excellent medium in which to encourage literacy.

* An audience creates a greater purpose for writing.
* Children need freedom to write about experiences that excite and enthuse them.
* Assessment of growth over time is essential.
* Cognitive processes should be stimulated and supported.

Implications for the design of computer writing application based on the preceding precepts formulated by the report's authors included:

* Writing programs for children should encourage and support them in efforts to make literature connections.
* Copies of children's work should be easily produced for audience and public display.
* A child should be able to make decisions about what to write. Capacity for other features to be added as the child's interest grows should be included in the design.
* Users should be able to save work easily and in a form that is easily retrievable.
* Writing applications should provide prompts that support the recall of information (1993, 7-8).

Using the design implications mentioned above, *Hypertales* was created to encourage children to interact with literature. In this computer program, students choose illustrations representing stories they have encountered. They enter text about the illustration and are able to print the text and the illustration. A copy of the text is automatically made in a file for teacher use and assessment.

Teachers are able to update the selections of literature to which students may respond and provide the students with an ever-increasing number of topics which they might choose to write about. With beginning writers as the focus, the authors stated that cognitive and developmental approaches to literacy can provide the principles for designing writing applications (1993, 11).

However, HyperTales is an example of a program that does not allow the use of the more unconventional forms of writing, such as scribbling and drawing, that emergent writers need to experiment with.

The final document examined computers as a writing tool in both kindergarten and first grade classrooms. Kerry Olson and Jerome Johnston worked on a multi-year project aimed at examining various strategies for improving the literacy development of children (1989). Computer programs selected included *Magic Slate* for the first grade and *Color Me* and *Muppet Slate* for the kindergartners. Software in this study did not allow for scribble, drawing, or letter-like forms. This limited the ability to depict the developmental level of the child or to make comparisons with non-computer writing.

However, this study did provide an opportunity, under controlled conditions, to look at the following areas: how children write and reread from their own computer writings, what patterns emerge as children write, how the writing process with a computer differs from that of paper and pencil, if the computer programs helped or hindered composition, attitudes toward writing on the computer, and mastery levels and conceptual

understanding. In addition, the study also looked at the nature of collaboration as the children worked together at the computers.

Similarities between writing with paper and pencil and computer writing included: writing with invented and/or conventional spellings, using a variety of writing forms for different writing purposes, and all forms of emergent writing were present.

Differences between the two included:

- Children paused to reread their compositions more often when using the computer.
- Letter names were pronounced more often in computer writing.
- Some children edited more readily at the computer.

Collaboration was also present among the children as they wrote at the computer. Most often it was in the context of one child waiting to use the computer and being drawn into the action that was present while s/he waited. Sometimes, children decided to write stories together. However, this type of collaboration was usually rare (29).

Student attitude toward computers was positive. The children demonstrated visible pleasure when working at the computer. One-third of the children maintained a high level of interest in writing on the computer. The majority liked to write stories, and most liked to write on the computer because "it was fun" (37).

By the end of the study, most of the children thought of the computer as a writing tool. At least two children displayed a higher writing level on the computer than what they had demonstrated using paper and pencil. The computer was highly motivating and appealing for some children.

As the author states, "The point to be made here is not that the computer is a unique tool for advancing a child from one stage of writing to the next, but rather that it is a context in which these transitions do occur, just as they do when they are writing with paper and pencil." (25).

The available research and literature, although limited, has several implications for the formation of future research regarding writing with computers and emergent literacy.

First and foremost is the development or use of a tool that allows children to move easily across all forms of writing. From an emergent literacy perspective, the ideal computer writing programs should allow the child to move freely across all the emergent, as well as conventional, forms of writing: drawing, scribbling, random letter strings, and invented spelling (8). Such a program would be more likely to encourage children to produce writing that is similar to what they do with pencil and paper.

Another implication concerns the need to develop reading programs that incorporate all areas of the reading process, using the multiple cueing systems of the text. Readers need to be able to exercise the selectivity and choice in attention that they would demonstrate in normal reading conditions.

The final implication concerns the use of illustrations for recall of textual information. Illustrations can enhance the recall and comprehension of written text. They help students organize information, recall facts and details, and provide clues to the semantic meaning of the text (Kelly &

O'Kelly, 1993, 6). Computer programs that incorporate all the emergent writing forms should be capable of enabling the student to illustrate the written text.

Computer writing applications need to be carefully orchestrated. As in any emergent literacy activity, children need to continue to build on what they know about literacy and to use it in further learning (Strickland, 1990, 21).

As children write on computers and grow in their literary knowledge, their feelings of ownership and self-confidence increase. They feel like real authors and begin to make the connections between the different forms of writing (Keeton, 1991, 528). Word ownership becomes a reality as children recognize the connection between print and what they write. The computer becomes an important tool for maintaining student interest and motivation in writing.

PROJECT DESCRIPTION

Method

Twenty-nine kindergarten students attending North Star Elementary in Nikiski, Alaska, participated in this project. Approximately half of the students was selected to write on the computer for ten to fifteen minutes every day. The other half was used as a control group, writing in journals for ten to fifteen minutes every day.

Emergent reading activities and writing activities continued in the classroom normally. However, during these writing periods, teachers did not directly help the students as they wrote. Instead, both journal and computer writing were modeled by the teacher. Care was taken to limit teacher directed writing activities. Students were allowed to pursue individual, independent writing activities that they initiated themselves.

All students in both groups had previous computer experience and were proficient in word processing. Students could select the Kidpix program, activate the drawing or the writing mode they desired, edit, delete, erase, and print their stories. The only area they needed help in was in saving their stories on the hard drive.

Materials

Students who participated in the computer writing group worked on Mac LC520 computers in the school's computer lab. Their were twenty-six stations; each child was able to work on his own computer. A laser printer was available; each child was able to print his story each day. *Kidpix* was the computer program used, since it was the one of the two available that would best facilitate emergent writing. Options in the program exist for student selection of either a drawing mode or word processing mode. Since they had previously learned how to run the program, no time was needed for training in use of the computer.

The control group wrote with pencils in their journals, spiral notebooks kept in the classroom.

Procedure

Students were given a pre-test. They were required to write on a topic of their choice using paper and pencil for a time of fifteen minutes. After the pre-test, their writings were divided into three groups: those that could be read, those with letter or letter-like forms, and those with drawing or scribbling forms. Randomly drawing the papers from each of the three groups determined which children would participate in the computer writing group. The remaining children were used as the control group.

Each group was required to write every day for ten to fifteen minutes each day. Students in the computer group printed their stories each day and kept them in a file in the classroom. Students were allowed to share their writing if they desired.

The children participated in this study for one month from January 28, 1994 until February 27, 1994. They used no other writing implements during the computer or journal writing times except for the one specified for their group. Teachers sometimes provided topics for the children to write about. Many times student could write on topics of their choice.

At the end of the study, students were post-tested. They were again required to write for fifteen minutes using paper and pencil on a subject of their choice.

Both pre- and post -tests were classified according to Sulzby's classification scheme for emergent writing (see Appendix A). Other assessment tools included a survey of student attitudes concerning writing (see Appendix B), and teacher observations of student work habits in the classroom and in the computer lab.

Data

Data from each group was organized into a chart that indicated the level of emergent writing for both pre- and post-tests. Many of the children demonstrated a growth in their writing, as depicted by the data on both charts (see data charts, Appendix C).

In the computer writing group, Christina's pre-test was classified on the drawing level, while her post-test indicated she was using invented spelling on an intermediate level.

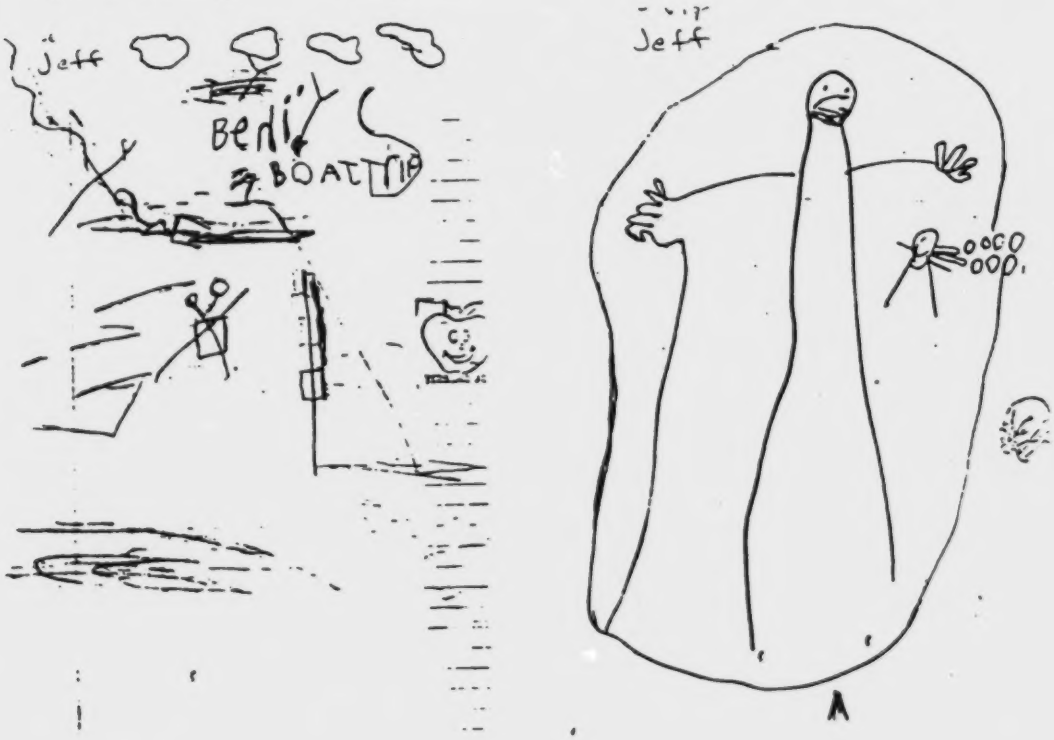
* Christina's Writing

Pre-test

Post-test
"I went outside and played."

Jeff demonstrated moderate growth. He moved from a drawing form of writing to writing with a combination of random letters and copying.

* Jeff's Writing



Pre-test Post-test

For several students there was little or no change in writing form. Even though the difference between pre- and post-tests showed little change, examination of the samples indicated improvement in writing form for some students.

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Hannah's writing appears more refined on the post-test. Her spelling is very close to being conventional and spacing of her words and sentences is more uniform. Her post-test is much easier to read than her pre-test.

* Hannah's Writing

Pre-test
"My brother uses my stuff when I don't want him to. He never wants to go to sleep so we let him go at Sunday."

Post-test
"I love my wild rabbit."

Jessie also demonstrated refinement in her writing. Words in her pre-test were written across the page and then down the left-hand column, one

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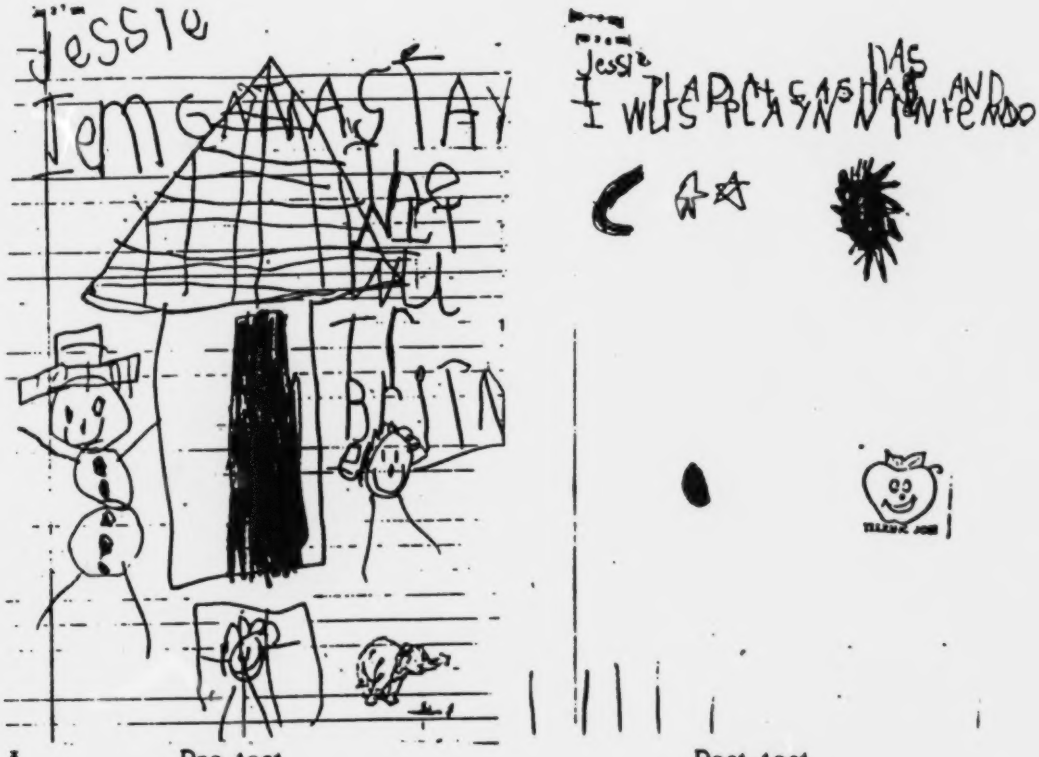
under the other. In the post-test, she has begun using spacing between her words and her sentences are more linear. The post-test is much easier to read than the pre-test.

* Jessie's Writing

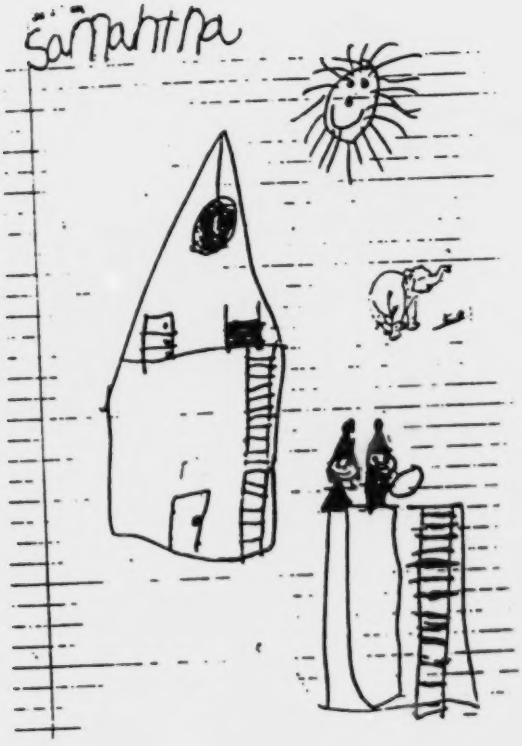


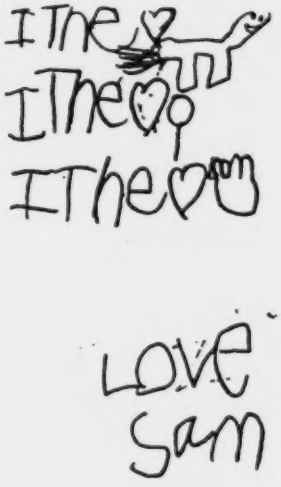
Pre-test
"I am going to stay the night with Brittany."

Post-test
"I played at Sasha's house and I was playing Nintendo."

In the control group, more growth was evident. Rick and Sam showed significant growth. Sam moved from a drawing form to a combination of writing with symbols and memorized words.

* Sam's Writing





Pre-test

Post-test

Rick used a drawing form in his pre-test and an intermediate invented spelling form in his post-test.

- Rick's Writing

Pre-test

Post-test
"I went to the lake on my snowmachine."

Moderate growth was evident in Jerry, Ashley, and Kevin. Jerry began with a drawing form and ended with the letterlike units form.

* Jerry's Writing

Pre-test Post-test

Ashley wrote letters in patterns and advanced to an invented spelling form that was partially syllabic and partially intermediate.

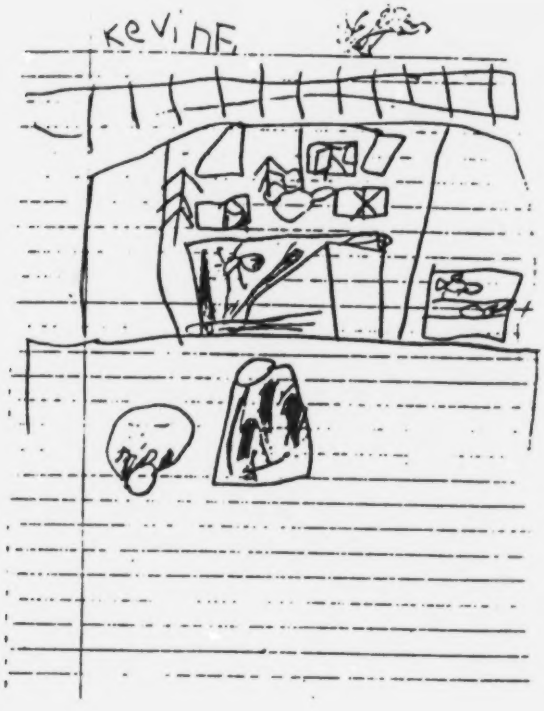
* Ashley's Writing

* Pre-test

Post-test
"Read the book. I like school."

Kevin's pre-test was classified as drawing, while his post-test was written using the letters in patterns form.

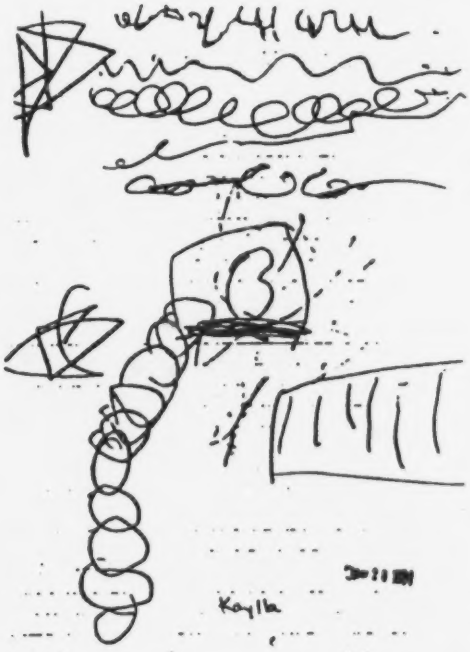
• Kevin's Writing



• Pre-test Post-test

Examination of the writing samples also showed improvement in the control group that was not indicated by looking only at the charts. Kaylla's pre-test was mainly composed of both wavy and letterlike scribble. A month later, her post-test showed she was writing using letterlike units. Her writing was beginning to resemble more conventional writing in the fact that you could now determine some of the letters used.

* Kaylla's Writing



Pre-test Post-test

Sasha was another student who demonstrated growth. Spacing was beginning to be used in her post-test. She was beginning to identify more than one sound in each of the words that she wrote. In the pre-test, the meaning of her sentence is unclear without a rereading by the author. In the post-test, with careful study, the written text can be deciphered.

- Sasha's Writing

Pre-test

Post-test
"I played at Jessie's and my house."

All students in the study were asked to respond to a survey about writing (see appendix B). This survey attempted to assess the student's attitudes towards writing, specifically writing with a computer. Responses to the first three questions are recorded in the following table.

Survey Responses

Question	# Always Responses	#Sometime Responses	# Never Responses
Do you like to write?	10	16	0
Do you like to write with paper and pencil?	13	130	0
Do you like to write with computers?	15	10	1

The next question on the survey pertained to what the students liked best about writing with paper and pencil. Responses were again varied. Four students thought writing with paper and pencil was fun, two liked to draw, three preferred making things, and two enjoyed writing words. Rick thought the best thing was "drawing was easier with pencils." Steven thought the best thing was because the "pencil made the writing black." Erica liked being able to erase.

The fifth question the children were asked was, "What do you like best about writing with computers?" Three students thought it was fun; two liked working with the Kidpix program; two liked making and mixing colors; and six students just liked writing on the computer.

Georgeanna thought the best thing about computers was that "you can print anything you want." Jessie liked writing about anything she chose on free days. Rick appreciated the fact that he could "make the letters better" and that there was "bigger paper with no lines on it." Christina liked not having to use pencils, while Tatiana stated that "We don't have to make the words. The computer makes the words."

The final two questions were related. The first attempted to discover the favorite writing tool of the students, and the second attempted to discover why they had their preferences. Students were sometimes confused about what was meant by "favorite way to write." In discussing this question, the teacher clarified that she wanted to know what was the favorite tool the child preferred to use in writing.

Student preferences were as follows:

Writing Tool	# of Responses
Markers	5
Pencils	6
Computers	5
Painting	2
Pens	1
Crayons	4
Both Computers & pencils	1
No preference	2

The students had a wide range of reasons for their preferences. The five who chose markers all had different responses. Following are their comments:

Georgeanna: They are real dark when they are new.

Jeff: Markers are reddish.

Chad: Blue is my favorite color of marker.

Sasha: They make pretty colors.

Amy: They're fun because they have ink on them.

Reasons for favoring pencils included:

Michael: I just do.

Marci: You can erase.

Kaylla: Because I can move my arm.

Hayley: I can't do S's very good with a marker.

Brandon: You can erase and draw.

Jessica: It helps me write.

Those who favored computers justified their preferences:

Justin:	You can do all kinds of programs.
Jessie:	It's fun.
Rick:	It's easier. You can make something by pushing buttons rather than a pencil. It's not so loud.
John:	You don't have to write the letters.
Christina:	It's fun. I like them.

Two students liked to paint. They commented:

Steven:	Because it drips down.
Justin W:	It's fun. You get to dip the sticks into the paint.

Sheri was the only student who preferred to use pens. She told me it was, "because you can see it better; you can erase with them."

All four students who chose crayons indicated it was the colors that appealed to them. They liked to write using a variety of colors.

Jerry was the student who liked using both computers and paper and pencil. His explanation was very simple: "I just like to write."

The two who had no preferences could give no reasons why they had no preference. They were content to write with whatever implement was on hand.

Thought was given to the sex and age differences between the children. Whether or not a child was an emergent reader who attended to the print was also given consideration. Preferences and writing performances did not seem to be affected by any of these factors.

Observations of student behavior provided some useful information about the students' attitudes toward writing. The computer students were eager to go to the computer lab every day. They frequently inquired as to how long until writing time. Another common question was, "Do we get to go to the Mac Lab today?"

Children in the control group were also eager to write in the computer lab. However, it was explained that for one month they had to write in their journals. The only way to appease this group was to promise them that they would have an equal amount of time in the computer lab when the study was concluded.

At first, students were hesitant about writing with the computers. Even though they had had previous experiences writing with the LC520's, they were uncertain about how to proceed. In the beginning of the study, some students' writing consisted only of their names. Gradually, they became more confident and began to aggressively pursue the options available to them using the Kidpix program.

By the end of the study, these students would explain that they were going to write first and draw a picture afterwards. Some of them even began asking, "Can I illustrate my story now?" They were very pleased that they could illustrate their writing like "real writers" do.

At the beginning of the study, the children were eager to print their work, usually within five minutes of having arrived in the computer lab. By the end of the study, the children would write the full fifteen minutes and often times did not want to quit. They had to be encouraged to come to a good stopping place so they could save or print their work.

Students had been writing in their journals since the beginning of the school year. Those students in the control group showed no hesitation in their writing. As stated before, they did display impatience and dissatisfaction at not having the opportunity to write in the Mac Lab. However, after they were shown, using a calendar, the time parameters of the study, they were content to continue journal writing since they knew they would soon get a turn also.

Students in both writing groups collaborated with each other about their writings. They offered each other suggestions and were always eager to share their writing. Students in the computer lab would often times line up to wait for their stories to be printed. They were always eager and excited to see the final results of their writing efforts.

Journal writers would always request to have sharing time in order to share their writing. Computer writers were more interested in making classroom books to share with the students in the control group. Books on rocks, mushing, and pet rocks were published during this four week period.

Analysis and Conclusions

Teacher observations and the survey results indicate that the students enjoyed writing. They were eager to learn, write, and share what they had written. After the initial hesitation about writing on the computer, the children settled down in both groups and began producing much written work.

Analysis of the data charts indicates that most of the students gained developmentally in writing forms. Students working in the control groups showed a more significant gain on the whole than did the students who wrote on computers. However, observation of students' work showed that all students made significant gains in writing.

Some children's writing forms changed significantly according to the classification scheme. Those whose forms did not change showed other growth in areas such as spacing, vocabulary development, left to right placement of words, and length of composition.

Working with the data pinpointed several difficulties with this study. One involved the pre-tests and post-tests. Personal knowledge of the students' performances in class caused doubt on some of the tests. As their teacher, I noted several discrepancies between what some students did on the pre-test as opposed to how they performed in school. The same can also be stated about the post-test.

Several of the students' writing consisted only of drawings. I knew from having worked with them previously, that some of them were capable of writing with other forms. They simply chose the drawing form for their writing on that day.

Students who wrote and did not draw (those who were developmentally beyond the drawing form) performed at the expected level. Since drawing is talked about in the classroom as a form of writing, this may have influenced the pre-tests.

To alleviate these discrepancies, four or five writing samples gathered at the beginning of the study instead of the pre-test would have given a

more valid assessment of what writing forms each student was most apt to use. Since the post-tests were also suspect, a sampling of student work would also have been preferable. This would have allowed a more accurate assessment of the types of writing forms that each student uses.

The length of time for the study also needs to be modified. It is unclear if the computer writing influenced growth or if this was the result of the natural growth of the students. A longer study, probably a minimum of four months, would allow enough time for differences to develop between the two groups. A one month study, even though the students wrote on the computer every day, does not clearly indicate the influence technology had on emergent writing development.

Valid conclusions about the effect of technology on the rate of development of emergent writers cannot be drawn. Analysis of the data indicates the control group made more progress, but without a more valid measure over a greater length of time, it cannot be explicitly stated to what extent technology effects emergent writers.

Some researchers are beginning to question if determining whether computers are superior to paper and pencil is relevant in regard to emergent writers (Kelly & O'Kelly, 1993, 11). Student responses to the survey validates that very thought. Preferences were varied and the children had definite ideas about the tools they elected to use.

Some of the students liked to write sometimes, a few all the time. Students' preferences for writing with paper and pencil were the same, while more children always liked to write with the computer compared to ten who sometimes did.

The children were interested in more than just "writing down words." They also demonstrated an awareness of texture and visual aesthetics which influenced the tool that they preferred. Choice of colors, mixing colors, making darker lines, and dripping down the paper are all phrases they used that illustrate this awareness.

No one tool was favored by the students over another. In fact, several answers were unexpected, such as the painting response. Since we had been talking about using paper and pencils or computers, I had expected the students to name one of those two choices. Their ideas about writing were much broader than mine. The wide range of these responses reveals that the students experience writing with a variety of tools.

Some of the tools they liked using were crayons and markers because of the colors that were available. Other children chose pens and pencils because they were dark, made nice lines, had points, and could be erased. Computers were fun, easy, and did the work for you. Painting was both a tactile and visual experience that two students enjoyed.

Teacher observations of the students validated the results of the survey. The children's eagerness to write, share, and collaborate with other students reflected the positive attitudes they have toward writing. These attitudes were evident in both the computer and control groups.

When accompanied by this favorable attitude, computers can help simplify the task of writing for children. Letters are more uniform and resemble the printed word children find in books. Technology may help

children make the connection between the spoken and printed word, and may do it more quickly; but more study needs to be done to see if that is indeed the case.

Since writing is multidimensional and occurs in all areas of life, the experience of writing becomes much more important than determining the type of writing tool that is used. The focus on technology should be one of encouraging emergent writers and providing a wide variety of experiences that supplement the children's knowledge of all types of literacy.

Appendix A

Sulzby's Classification Scheme for Forms of Writing

Category Child Uses	Description of Writing Form
Drawing	Draws on picture for entire composition
Scribble/wavy	Scribble is a continuous form without definition of letters
Scribble/letterlike	Different forms within the scribble and these forms have some of the features of letters
Letterlike Units	The forms may resemble letters, but they appear to be forms the child has created
Letters-random	There is no evidence the child made any letter sound correspondence
Letters-patterns	The child writes with letters that show repeated patterns
Letters-name elements	Letters are from the child's first and/or last name
Copying	The child will copy from environmental print in the room
Invented spelling: syllabic	The child uses only one letter per syllable (contains phonetic relationships between the sounds in the spoken words and letters used)
Invented spelling: intermediate	The invented spelling between syllabic and full
Invented spelling: full	There is a letter for all or almost all of the sounds in a spoken word
Conventional	The child uses conventional correct, or dictionary spelling
Other	The child uses a writing system that does not fit the descriptions above

adapted from Marjorie Fields & Katy Spangler. Let's Begin Reading Right, 3rd Edition. Used with permission from Elizabeth Sulzby, "Appendix 2.1: Forms of Writing and Rereading Example List." Jana M. Mason (ed.) Reading and Writing Connections. Allyn and Bacon. 1989.

Appendix B

Kindergarten Survey
Writing with Computers

1. Do you like to write?
   always sometimes never

2. Do you like to write with paper and pencil?
   always sometimes never

3. Do you like to write with computers?
   always sometimes never

4. What do you like best about writing with paper and pencil?

5. What do you like best about writing with computers?

6. What is your favorite way to write?

7. Why?

Name _____

Appendix C

Pre-test and Post-test Data
Using Sulzby's Classification Scheme

Table 1

Computer Writing Group		
Student	Pre-test Writing Form	Post-test Writing Form
Michael	Letters - random	Letters - patterns
Justin V.	Copying	Invented spelling: syllabic
Hannah	Invented spelling: intermediate	Invented spelling: full
Samantha	Copying	Invented spelling: intermediate
Georgeanna	Invented spelling: full	Invented spelling: full
Kaylla	Scribble/wavy	Letterlike Units
Sheri	Letters - random	Letters - name elements
Hayley	Letters - name elements	Letters - name elements
Brandon	Letters - random	Letters - name elements
Amy	Scribble/letterlike	Scribble/letterlike
Christina	Drawing	Invented spelling: intermediate
John	Letters - random	Letters - name elements
Jeff	Drawing	Letters - random; copying
Jessie	Invented Spelling: intermediate	Invented spelling: full

Table 2

Journal Writing Group		
Student	Pre-test Writing Form	Post-test Writing Form
Jessica	Letters - patterns	Letters - patterns
Anna	Invented spelling: intermediate	Invented spelling: full
Marci	Invented spelling: intermediate	Invented spelling: full
Rick	Drawing	Invented spelling: intermediate
Jerry	Drawing	Letterlike Units
Erica	Copying	Invented spelling: intermediate
Steven	Letters - patterns	Letters - name elements
Ashlee	Letterlike Units	Copying
Ashley	Letters - patterns	Invented Spelling: syllabic and intermediate
Chad	Letterlike Units	Letters - random
Kevin	Drawing	Letters - patterns
Sam	Drawing	Other form not described
Justin D	Copying	Invented spelling: syllabic
Sasha	Invented spelling: syllabic	Invented spelling: intermediate
Tatiana	Invented spelling: intermediate	Invented spelling: intermediate

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References

Keeton, B. L. (1991). Computer Printers and Ownership of Writing.. *The Reading Teacher*, 44(7), 527-528.

Fields, M., & Spangler, K. (1994). *Let's Begin Reading Right, 3rd Edition*, 124.

Kelly, A. E. & O'Kelly, J. B. (1993). Emergent Literacy: Implications for the Design of Computer Writing Applications for Young Children. *Journal of Computing in Childhood Education*, 4(1), 3-14.

Moxley, R. A. & Warash, B. G. (1992). Writing Strategies of Three Prekindergarten Children on the Microcomputer. *Journal of Computing in Childhood Education*, 3, 137-179.

Murphy, S. (1991). The Code, Connectionism, and Basals. *Language Arts*, 68, 199-205.

Olson, K. & Johnston, J. (1989). *The Use of the Computer as a Writing Tool in a Kindergarten and First Grade Classroom*. Ann Arbor, Michigan: Ann Arbor School of Education.

Strickland, D. (1990). Emergent Literacy: How Young Children Learn to Read. *Educational Leadership*, 47(6), 18-23.

Sulzby, E. (1992). Research Directions: Transitions from Emergent to Conventional Writing. *Language Arts*, 69, 290-297.